

CONTRACT CHANGE ORDER

Change Requested by: Engineer

CCO: 167 Suppl. No. 0 Contract No. 04 – 0120F4 Road SF-80-13.2/13.9 FED. AID LOC.:**To: AMERICAN BRIDGE/FLUOR ENTERPRISES INC A JOINT VENTURE**

You are directed to make the following changes from the plans and specifications or do the following described work not included in the plans and specifications for this contract. **NOTE: This change order is not effective until approved by the Engineer.**

Description of work to be done, estimate of quantities and prices to be paid. (Segregate between additional work at contract price, agreed price and force account.) Unless otherwise stated, rates for rental of equipment cover only such time as equipment is actually used and no allowance will be made for idle time. This last percentage shown is the net accumulated increase or decrease from the original quantity in the Engineer's Estimate.

Extra Work at Lump Sum:

Item 1.

Furnish LED light fixtures in lieu of contract specified Metal Halide light fixtures for the 438 fixtures listed on Attachment A on sheet 5 of this change order. This work must meet all the requirements below and the attached revisions to Special Provisions Section 10-3.14 "LIGHTING" on sheets 6 through 13 of this change order.

I. Supplier Requirements

1. The selected LED fixture supplier shall be identified with the signed Change Order.
2. The supplier shall provide evidence that they have been in the business of street lighting or exterior large area lighting for a period of not less than 10 years.
3. A list with a minimum of 10 street lighting, or large area lighting projects successfully completed by the supplier shall be included with the signed Change Order. At least two of these projects must be from 8 or more years ago.

II. Submittals

The following submittals shall be submitted in the shop drawing process and be approved by the Engineer prior to start of production of the light fixtures. Each item shall be provided in the form of clear and concise statements and/or plans and drawings, which can be easily read and clearly interpreted. Each item shall also be clearly numbered to correspond with the following list. All items shall be assembled in the order indicated and secured or bound in a neat and orderly fashion for easy use and reference.

1. Computer generated illumination levels demonstrating compliance with the specified initial and maintained light levels and uniformities.
2. A copy of the photometric testing report performed per LM-79-08 and conducted by an NVLAP approved or CALiPER qualified testing laboratory. Include documents verifying laboratory accreditation.
3. Test data from the LED supplier taken per LM-80-08 guidelines to support the lamps' lumen maintenance predictions.
4. Provide technical information in the form of cut sheets for the Power Supplies verifying compliance to this specification for Harmonic Distortion, RF Interference, IP Rating, and Efficiency Rating.
5. Supply Surge Protection Device documentation verifying compliance with UL 1449 or UL 1238.
6. A written copy of the supplier's warranty covering all materials, workmanship, and labor for a period of 10 years or greater.

III. Lighting Criteria

- A. Computer Predicted Illumination Summaries shall be provided on a 20' x 20' grid illustrating the predicted initial and maintained illumination values and uniformities.
- B. The roadway lighting system shall illuminate the entire deck surface (driving lanes and shoulders) to a minimum of 2.15 initial average footcandles with a 3:1 maximum allowable average to minimum ratio.
- C. The supplier shall apply an L70 (70% lumen maintenance factor) for the maintained illuminance values. Maintained illuminance levels shall be 1.5 average footcandles with a 3:1 average to minimum ratio. The maintained footcandle for Belvedere area shall be 3.0.
- D. In lieu of item III.B, the supplier may employ a constant illumination scheme in which the maintained illumination levels are achieved initially and the output of the fixture is increased over time to assure the illumination levels are always met.
- E. In either case, the supplier must guarantee the illumination levels will be met for the entire warranty period.

IV. Fixture Design & Construction

- A. Fixture
 1. Construction

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- a. The luminaire shall consist of an aluminum housing with tempered glass lens, gasketed to seal the internal LED light sources and internal optics. Each LED shall be individually visored to mitigate glare to oncoming traffic and other areas off the bridge deck. The fixture shall be IP-66 rated and the shape shall be closely similar in shape and size to the conceptual design of original contract's metal halide fixtures, unless otherwise approved by the Engineer.
- b. The front face of the housing shall be circular in shape with a smooth conical side view. It shall be of adequate size and mass to provide the necessary heat dissipation to limit the LED junction temperature to 90 °C or less at an ambient temperature of 25 °C. The LED's shall be circuited such that failure of a single LED does not result in the loss of the entire luminaire.
- c. The fixture assembly must be fabricated with materials and coatings that allow it to withstand a 3,000 hour salt spray test under ASTM B 117, this applies to all fixture types.
- d. Heat dissipation shall be by passive design. Fans or other mechanical cooling devices shall not be permitted.
- e. Heat dissipating fins shall be oriented to minimize the build-up of water or debris on the fixture and allow rain water to freely carry dust and debris away.
- f. If a photoelectric receptacle is to be included, a rain tight cap must be provided. The receptacle must comply with Section 86-6.08B(1), "Photoelectric Unit", of the Standard Specifications.
- g. A quick attaching safety cable shall be affixed to all units to secure the fixture to the mounting cable or pole.
- h. Fixtures shall be painted to match Federal Standard 595B ranges matching the Bridge Paint color.

2. Light Sources

- a. LED color temperature shall have a nominal color temperature of 4,250° Kelvin, +/- 250° K. L70 lumen maintenance of the LED's shall be rated for a minimum of 63,000 hours for all fixtures except for the MAM & MAP fixtures, which are rated for a minimum of 50,000 hours.
- b. The supplier shall supply the LED suppliers test data performed per LM-80-08 guidelines to support the lamps' lumen maintenance.

B. Structural Attachment

1. The individual cable light fixtures shall be designed to match the original contract's mounting configuration and no changes are allowed unless approved by the engineer.
2. The individual fixtures for the light poles shall be assembled to a welded tubular steel assembly that doubles as a wireway.
3. The tubular steel structure, fixtures, and all attachment points shall be designed by the supplier and approved by the Engineer.
4. Wiring for the light pole fixtures shall transition internally from the fixture to the structural attachment and from the structural attachment into the pole. There shall be no external conduits or SO Cords between the fixtures on the tubular steel structure.
5. All mountings and Structural attachments shall be hot-dipped galvanized and then powder coat painted to match the Bridge color.

C. Drivers & Wiring

1. Drivers, Control Boards, & all associated electrical equipment shall be mounted as per the original contract documents for all cable light fixtures, unless approved by the engineer. On the light poles they can be located inside the pole near the bottom across from the handhole opening.
2. Power Supplies shall be rated IP-66 minimum, have an efficiency of not less than 90% when operated at maximum load, and be power factor corrected (minimum 90%).
3. The RF interference of the power supplies and luminaires must meet Class A emission limits per Federal Communications Commission Title 47 Subpart B, Section 15 or EN61000-4-6.
4. The Total Harmonic Distortion (THD) of the power supply and fixtures shall be in compliance with EN61000-3-2.
5. The power supplies shall be rated to operate on a nominal 60 HZ, 480VAC input and rated for operation between temperatures of -25 °C – 55 °C.
6. The supplier shall supply a Surge Protection Device (SPD) to protect the fixtures from damage or failure due to transient voltages or currents. SPD must conform to UL 1449 or UL 1238, dependent upon the components used in the design.
7. A wire harness shall be provided by the fixture supplier to connect the LED Drivers and associated electrical equipment located at the bottom of the pole to the fixtures mounted at the top of the pole. The harnesses shall have quick connect plugs on both ends for easy installation and replacement of the drivers or fixtures and shall be encased in a plastic corrugated sleeve to protect it from abrasion inside the pole.

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8. All conductors running from the power supplies at the bottom of the pole to the fixtures at the top of the pole shall be run internal to either the pole or the structural attachment of the fixture to the pole. Externally run conduits or SO Cords shall not be permitted.

D. Testing

1. Prior to production, the supplier shall provide a sample fixture of each different model they intend to provide for testing and verification. The fixtures must have been previously tested by the supplier for verification of the Junction Temperature (90 C), LED Solder Point Temperature, and ambient air temperature adjacent to the solder point at maximum operating wattage. Placement of temperature sensors shall be as follows:
 - a. One device at the LED solder point to determine Solder Point Temperature.
 - b. One device adjacent to the solder point to measure internal ambient air temperature.
 - c. One device located at the center of the fixture at the point where the LED optical & mechanical assembly attaches to the heat sink.
 - d. Junction Temperature shall be calculated by adding the Solder Point Temperature to the LED supplier's rated thermal resistance in degrees Celsius per Watt.
2. The supplier shall supply their test data to the Department along with the production sample. Data shall include:
 - a. Maximum allowable operating power to the LED board in watts.
 - b. Input voltage to the fixture when the testing was conducted at the supplier's facility.
 - c. The LED supplier's rated thermal resistance of the LED in degrees Celsius per Watt.
3. All measurements shall be taken after the fixture has operated at maximum rated wattage for a minimum of 24 hours at an ambient temperature of 70 °F (21 °C) or greater.

V. Warranty for the LED fixtures and all related components procured under this change order:

- A. The supplier shall warrant or insure the products to be free from defects in materials and workmanship for a period of not less than 10 years. This warranty or insurance shall cover all materials and labor (including removal & installation) during the 10-year period.
- B. In the event that a fixture needs to be repaired or replaced within the 10-year warranty period, The Department will be responsible for the costs associated with lane closures & traffic control. The supplier shall be responsible for all costs associated with repair and/or replacement of the fixture including the necessary lifts and labor.
- C. The Supplier's warranty or insurance policy will be provided directly from the Supplier to the Department. Upon acceptance of the Work, the Department agrees to release the Contractor (ABFJV) and the electrical subcontractor (Bleyco Electric) from any and all liability, loss or damage, which may result directly or indirectly from any defects in materials or workmanship in the LED fixtures and all related components procured under this change order.

The scope described above and attached specifications for this change order shall govern over the contract Special Provisions, Standard Specifications and Standard Plans where any conflict exists.

For this work, the Contractor will receive a lump sum price of \$1,456,614.00. This sum constitutes full and complete compensation for furnishing all labor, material, tools and incidentals including all markups by reason of this change. The installation cost for all fixtures are already included in the original contract scope of work.

Extra Work at Lump Sum.....\$1,456,614.00

Extra Work at Force Account:

Item 2.

For any minor additional work as directed by the Engineer, necessary for fabrication and installation of the fixtures & other components, which cost is not covered by the lump sum amount above and the original scope of the contract.

Labor, equipment and material authorized by the Engineer, as necessary, will be paid in accordance with the provisions of Section 4-1.03D, "Extra Work" of the Standard Specifications and Section 5-1.24, "Force Account Payment" of the Special Provisions.

Estimated Cost of Extra Work at Force Account.....\$100,000.00

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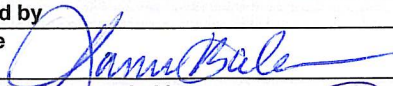
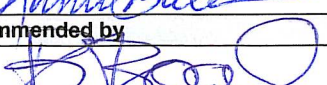
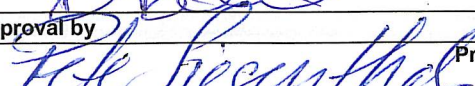
CHANGE ORDER COST AND TIME SUMMARY

(ITEM 1) Extra Work at Lump Sum.....	\$1,456,614.00
(ITEM 2) Extra Work at Force Account	\$100,000.00
Total net pay for this change order	\$1,556,614.00

This sum constitutes full and complete compensation for furnishing all labor, material, tools and incidentals including all markups by reason of this change.


Estimated Cost: Increase ☒ Decrease ☐ \$1,556,614.00

By reason of this order the time of completion will be adjusted as follows: 0 Days

Submitted by			
Signature 	Resident Engineer	Kannu Balan, Senior T.E.	Date 1-31-2011
Approval Recommended by			
Signature 	Supervising Bridge Engineer	Brian Boal, Actg. Sup. B.E.	Date 31 JAN 2011
Engineer Approval by			
Signature 	Principal Transportation Engineer	Peter Siegenthaler, Prin. T.E.	Date 2-10-11

We the undersigned contractor, have given careful consideration to the change proposed and agree, if this proposal is approved, that we will provide all equipment, furnish the materials, except as otherwise be noted above, and perform all services necessary for the work above specified, and will accept as full payment therefor the prices shown above.

NOTE: If you, the contractor, do not sign acceptance of this order, your attention is directed to the requirements of the specifications as to proceeding with the ordered work and filing a written protest within the time therein specified.

Contractor Acceptance by		
Signature 	(Print name and title) BRIAN A. PETERSEN - PROJECT DIRECTOR	Date 09 FEB 11

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Attachment A**480V MAD, MAR, MAT, MAU, MSR, MAM, MSV, MAP FIXTURES
QUANTITIES AND NOTES**

FIXTURE TYPE	LAMP WATTAGE	QUANTITY	TENON MOUNT	WALL MOUNT	SUSPENSION CABLE	ROADWAY POLE	SUSPENDER BRACKET		Other	GENERAL LOCATION
							TYPE I	TYPE II		
MAD- 2C	400	42			42					downlights on
MAD- 3C	250	24			24					suspension cable
MAD- 4C	175	18			18					
MAR- 2-PB	400	4	4							lights on pier
MAR- 2A-PB	400	8	8							
MAT- 1A	1000	16	16							fixtures on bridge
MAT- 1B	1000	8	8							deck and crossbeam
MAT- 1C	1000	4	4							
MAT- 3D	250	8	8							
MAT- 3RC	250	8		8						
MAU- 2A	400	4							4	uplights inside pylon
MAU- 2D	400	80					52	28		uplights on
MAU- 3D	250	48					48			suspender brackets
MAU- 4D	175	30					30			
MAU- 5D	100	8	8							
MSR- 2C	400	31			31					roadway lights on
MSR- 2A-C	400	4			4					suspension cable
MSR- 2B-C	400	15			15					
MSR-	400	48				48				roadway lights
										on poles
MAM- 3	250	12				12				marker light on pole
MSV	2-35	16				16				Belvedere bike path pole
MAP	250	2							2	Tower Top
TOTALS		438	56	8	134	76	130	28	6	

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In Special Provisions Section 10-3.14 insert the following after the last subsection "TESTING":

GENERAL LED LUMINAIRE REQUIREMENTS

The following general LED luminaire requirements shall apply to all fixtures for this change order unless otherwise specified by application.

Definitions

CALiPER: Commercially Available LED Product Evaluation and Reporting. A US DOE program for the testing and monitoring of commercially available LED luminaires and lights.

correlated color temperature: A visible light characteristic of comparing a light source to a theoretical heated black body radiator. Measured in Kelvin.

footcandle: Unit of illuminance; a measurement of light.

IP: International Protection rating, sometimes referred to as ingress protection, that delineates the level at which foreign objects and water can intrude inside a device.

L70: The extrapolated life in hours of the luminaire when the luminous output depreciates 30 percent from initial values.

NVLAP: National Voluntary Laboratory Accreditation Program under the US DOE to accredit independent testing laboratories to qualify.

power factor: Ratio of the real power component to the total, complex, power component.

surge protection device: A subsystem or component that can protect the unit against short duration voltage and current surges.

Transportation Electrical Equipment Specifications: A package of standard specifications for transportation related electrical equipment to be used on State Highways. This document is compiled by the Department.

total harmonic distortion: Amount of higher frequency power on the power line.

Submittals

All luminaires are subject to initial acceptance testing prior to main delivery. Main deliveries may be subject to additional random sample testing.

Submit test units to the Department after the manufacturer's testing is completed. Include the manufacturer's testing data.

Product submittals must be accompanied by:

1. Product specification sheets or other documentation that includes the designed parameters as detailed in the specification. The parameters include:
 - 1.1. Maximum power in watts
 - 1.2. Maximum designed junction temperature for the specific luminaire model
 - 1.3. L70 in hours when extrapolated for the average nighttime operating temperature
2. IES LM-79 and IES LM-80 compliant test reports from a CALiPER-qualified or NVLAP-approved testing laboratory for the specific model submitted.
3. Photometric file (IES) based on LM-79 test report.
4. Initial and End-of-Life lighting simulations showing lighting levels on the roadway for east bound and west bound directions.
5. Test report showing surge protection device (SPD) performance as tested under ANSI/IEEE C62.41.2 and ANSI/IEEE C62.45.
6. Test report showing mechanical vibration test results as tested under a modified California Test 611 as described below.
7. Datasheets from the LED manufacturer that includes information on life expectancy based on junction temperature.
8. Datasheets from power supply manufacturer that includes life expectancy information.

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Quality Control and Assurance

The luminaires must be manufactured under the manufacturer's quality assurance program. The program must include (1) production quality assurance and (2) design quality assurance.

Production quality assurance must include statistically-controlled routine tests to ensure minimum performance levels of the modules built to meet this specification and a documented process for resolving problems. The process and test results documentation must be kept on file for a minimum of 7 years.

Design quality assurance must be performed by the manufacturer or an independent testing lab hired by the manufacturer on new luminaire. The sample luminaires must be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, at a temperature of +70 °F before performing any design qualification testing.

One initial test unit shall be fitted with temperature sensors (either thermistor or thermo-couple). Temperature sensors shall be mounted on the LED solder pads as close to the LED as possible. One temperature sensor shall be mounted on the power supply (driver) case. Light bar or modular systems shall have one sensor for each module, mounted as close to the center of the module. Other configurations shall have at least 5 sensors per luminaire. Contact Caltrans for advice on sensor location. Thermocouples will be either Type K or Type C. Thermistors shall be negative temperature coefficient (NTC) type with a nominal resistance of 20k ohm. The appropriate thermocouple wire shall be used. The leads shall be a minimum of 6 ft. Documentation shall accompany the test unit that details the type of sensor used.

Any failure of the luminaire that renders the unit non-compliant with the specification after burn in must be rejected.

The luminaire must be tested under California Test No. 678 and as specified. Luminaire performance must be judged against the specified minimum illuminance in the specified pattern for a particular application. The luminaire lighting performance must be adjusted, depreciated, for the minimum operating life. The performance must be adjusted, depreciated, by using the LED manufacturer's data or the data from the LM-80 test report, whichever results in a higher level of lumen depreciation.

The Department may perform random sample testing on all shipments. Testing will be completed within 30 days after delivery to the Transportation Laboratory. Luminaires will be tested under California Test No. 678 and as specified. All parameters of the specification may be tested on the shipment sample.

Materials

General

The luminaire consists of an assembly that uses LEDs as the light source. In addition, a complete luminaire consists of a housing, an LED array, an electronic driver (power supply), and all associated electronics components. The luminaire must comply with the following requirements:

1. UL listed under UL 1598 for luminaires or an equivalent standard from a recognized testing laboratory
2. Have a minimum operational life is 63,000 hours, unless otherwise noted
3. Expected to operate at an average operating time of 11.5 hours per night
4. Designed to operate at an average nighttime operating temperature of 15°C (60 °F)
5. Have an operating temperature range from -25°C – 55°C (-13 °F to +130 °F).

The individual LEDs must be connected such that a catastrophic loss or a failure of 1 LED will not result in the loss of the entire luminaire.

Luminaire Identification

Each luminaire must have the following identification permanently marked inside the unit and outside of its packaging box:

1. Manufacturer's name
2. Trademark
3. Model number
4. Serial number
5. Date of manufacture (month-year)

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6. Lot number

The rated voltage and rated power (in watts) must be permanently marked inside each unit.

Photometric Requirements

Photometric performance shall depend on the application of the luminaire. See the application for these requirements.

The luminaire must have a correlated color temperature in the range of 4,000K to 4,500K

The color rendition index must be 70 or greater.

Thermal Management

The thermal management of the heat generated by the LEDs must be of sufficient capacity to assure proper operation of the luminaire over the minimum operation life. The LED manufacturer's maximum junction temperature for the minimum operation life must not be exceeded. The maximum allowed junction temperature is 90 °C.

The junction-to-ambient thermal resistance must be 35 °C per watt or less. Thermal management must be passive by design. The use of fans or other mechanical devices is not allowed. The heat sink material must be aluminum or other material of equal or lower thermal resistance.

Physical and Mechanical Requirements

The housing must be fabricated from materials that are designed to withstand a 3000-hour salt spray test under ASTM B 117. All aluminum used in housings and brackets shall be a marine grade alloy with less than 0.2% copper. All aluminum shall be anodized.

Each refractor or TIR lens must be made from UV-inhibited high impact plastic (such as acrylic or polycarbonate) or heat and impact resistant glass, and be resistant to scratching.

Paint or powder coating of the housing must comply with Section 86, "Electrical Systems," of the Standard Specifications. A chromate conversion undercoating shall be used underneath a thermoplastic polyester powder coat.

The luminaire must be a single, self-contained device, not requiring on-site assembly for installation.

The assembly and manufacturing process for the LED luminaire must be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. The luminaires and mounting device, when tested under a modified California Test 611, must be capable of withstanding the following cyclic loadings in units of acceleration of gravity, G:

1. Vertical plane (z axis) at a minimum peak acceleration level of 3.0 G peak-to-peak sinusoidal loading (same as 1.5 G peak), for a minimum of 2 million cycles without failure of any luminaire parts
2. Horizontal plane (x axis) at a minimum peak acceleration level of 1.5 G peak-to-peak sinusoidal loading (same as 0.75 G peak), for a minimum of 2 million cycles without failure of any luminaire parts
3. Horizontal plane (y axis) at a minimum peak acceleration level of 1.5 G peak-to-peak sinusoidal loading (same as 0.75 G peak), for a minimum of 2 million cycles without failure of any luminaire parts

The housing must be designed to prevent the build up of water on the top of the housing. Exposed heat sink fins must be oriented to allow the water to freely run off the luminaire and carry dust and other accumulated debris away from the unit.

The optical assembly of the luminaire must be protected against dust and moisture intrusion per the minimum requirements of IP-66.

The electronics/power supply enclosure must be protected per the minimum requirements of IP-55.

Field wires connected to the luminaire must terminate on a barrier type terminal block secured to the housing. The terminal screws must be captive and equipped with wire grips for conductors up to No. 6. Each terminal position must be clearly identified. Weather-tight connectors, approved by the Engineer, may be used.

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Power Supply Electrical

The power supply shall be able to operate on a standard 60 Hz ± 3 Hz AC line with a nominal voltage of 480 VAC between ungrounded conductors.

The power factor shall be 0.90 or greater,

Total harmonic distortion (current and voltage) induced into an AC power line must not exceed 20 percent.

The power supply shall be rated for outdoor operation. The power supply shall have a minimum IP rating of IP65.

The power supply shall be rated for a minimum operational life equal to the minimum operation life of the luminaire, or greater.

The power supply case temperature must have a self rise of 25° C or less above ambient temperature in free air with no additional heat sinks.

The power supply must support remote location of up to 100 feet distance from the luminaire. The power supply manufacturer will supply information on recommended wire sizes to achieve the remote location.

The 480V drive (power supply) must support industry standard 0 to 10 V DC control.

Surge Suppression and Electromagnetic Interference

The luminaire must include a surge suppression device to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The surge suppression device must protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41.2 (Tables 1 and 4) for Location Category C-High. The surge suppression device must conform to UL 1449 or UL 1283, depending of the components used in the design. Surge suppression device performance must be tested under ANSI/IEEE C62.41.45 based on ANSI/IEEE C62.41.2 definitions for standard and optional waveforms for Location Category C-High. The surge suppression device may be external to the power supply. For remotely located power supplies, the surge suppression device shall be located adjacent to the power supply.

The luminaires and associated on-board circuitry must meet EN61000-4-6 or Class A emission limits under FCC Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

Compatibility

The luminaire must be operationally compatible with currently used lighting control systems and photoelectric controls.

Roadway Luminaires Types MSR

Pole and cable mounted roadway luminaires shall be light emitting diode (LED) floodlights with a mounting suitable for the location shown on the plans.

The face of the fixture shall be circular in shape, similar to the conceptual design plans. A prototype luminaire shall be submitted for architectural approval prior to delivery.

Each roadway and suspender cable luminaire shall be equipped with a fully adjustable aiming device necessary to achieve the specified light levels and uniformities. Aiming device shall be as shown on the plans or equal, allowing for at least 3 axis of movement (± 90 degrees) for aiming. Mounting devices shall be approved by the engineer.

The mounting device shall have easily read etched or stamped angle markings at the pivot points.

Mounting device and hardware shall be Type 316 stainless steel, or of other material of sufficient strength and corrosion resistance

Luminaire, mounting device and hardware shall be powder coated with a white finish as selected by the architect.

Luminaires shall be fully assembled, and ready for installation.

Electrical/Photometric Requirements

Roadway Luminaires shall come in no more than two wattages (max wattages: 300 w and 200 w) and no more than three beam configurations for a total of six different roadway luminaires (similar to original metal halide plans), unless needed and approved by engineer to meet the photometric requirements listed below, a table of roadway luminaire types is provided with the original metal halide information. As part of the product submittal, the supplier shall complete the table with the required information for the LED luminaires.

Photometric requirements are that the roadway luminaires maintain an average of 1.5 foot-candles for the

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minimum operational life of the luminaires. Uniformity shall be limited by a MAX to MIN ratio of 10 to 1, and an AVE to MIN ratio of 3 to 1. A table of roadway luminaire installations is provided with original metal halide details. The supplier shall complete the table with the required information for the LED luminaire installations and final aiming coordinates. The supplier shall specify the type and quantity of LED luminaires to achieve the required photometric performance

Supplier shall provide computer generated point by point lighting calculations showing that luminaire types and quantities will meet the required performance at installation and throughout minimum operational life.

For pole mounted luminaires, the driver and all associated electronics shall be located in the base of the pole.

For cable mounted luminaires, the power supply shall be located in a box on the cable clamp/platform.

Roadway Luminaires (YSR, MSR, SSR, OSR))

Luminaire Type	Original Metal Halide					LED Luminaire		
	Wattage*	Beam Angle	Field Angle	NEMA	Quantity	Wattage	Beam Designation	Quantity
xSR-2	400	5 x 5	15 x 15	1h x 1v	192			
xSR-2a	400	35 x 6	50 x 12	4h x 1v	4			
xSR-2b	400	50 x 50	95 x 95	5h x 5v	238			
xSR-3	250	5 x 5	15 x 15	1h x 1v	153			
xSR-3a	250	35 x 6	50 x 12	4h x 1v	84			

Pole Mounted Marker Lights Type MAM

Pole mounted marker light fixture shall be a 200 mm diameter (approx) lantern using LEDs as the light source. Each fixture shall be shipped fully assembled, furnished with lamps, power supply, transformer, and base and fixture caps, and shall comply with the following requirements.

The fixture shall be cylindrical in shape, similar to the conceptual design plans. A prototype luminaire shall be submitted for architectural approval prior to delivery.

Each fixture shall have a maximum power consumption of 125 watts.

The fixture shall be IP-66 rated and be constructed of materials and coatings to allow it to pass a 3,000 hour salt spray test per ASTM B 117.

The driver shall be IP-65 rated and remote mounted at the base of the pole with the roadway lighting drivers. The manufacturer shall supply a wire harness to connect the driver at the bottom of the pole to the fixture at the top of the pole.

The fixture, driver, and wire harness shall have quick-connect electrical connections. The harness shall be encased in a corrugated plastic tubing to protect the wires from abrasion from the inside of the pole.

Housing Material

Housing shall consist of anodized aluminum base plate with an anodized aluminum mounting cylinder and a removable anodized aluminum cape secured to the fixture with a threaded cap anchor. Aluminum shall be a marine grade alloy with less than 0.2% copper.

Fixtures shall be equipped with a cast mounting base, suitable for surface mounting to the Roadway Lighting Pole top. Mounting hardware shall be Type 316 stainless steel.

Fixtures shall be UL listed for use in wet locations.

Photometric Requirements

The fixture shall provide a minimum intensity of 500 candelas at any point on the horizontal plane and have a minimum beam angle of 60 degrees (between the angles of 30 degrees above and below the horizon) for a minimum operational life of 50,000 hours.

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Marker Lights (YAM, MAM, SAM, OAM, MAP)

Luminaire Type	Original Metal Halide					LED Luminaire		
	Wattage*	Beam Angle	Field Angle	NEMA	Quantity	Wattage	Beam Designation	Quantity
xAM-3	250				80			
xAM-4	175				28			
xAM-5	100				43			
xAM-6	60				21			
MAP	400				2			

Belvedere Lights Type MSV

Belvedere light fixtures shall be light emitting diode (LED) fixtures with a mounting suitable for the location shown on the plans.

Luminaire, mounting device and hardware shall be powder coated with a white finish as selected by the architect.

Fixtures shall be equipped with a fully adjustable mounting method to achieve the necessary horizontal and vertical aiming angles (mounting device). Fixture and power supply shall be suitable for surface and pole mounted applications.

Mounting device and hardware shall be Type 316 stainless steel, or of other material of sufficient strength and corrosion resistance.

Electrical/Photometric Requirements

Belvedere luminaires shall consume no more than 35 watts including power supply. A table of luminaire types is provided with the original metal halide information. The supplier shall complete the table with the required information for the LED luminaires.

The maintained footcandle for Belvedere area to be 3.0, over the minimum operational life. The beam spread shall be equivalent to NEMA 3H x 3V pattern or whatever deemed necessary to provide adequate coverage on the area and approved by the engineer.

The power supply shall be remotely located from the luminaire in the box on the belvedere poles as shown on the plans.

Belvedere Luminaires (MSV)

Luminaire Type	Original Metal Halide					LED Luminaire		
	Wattage*	Beam Angle	Field angle	NEMA	Quantity	Wattage	Beam Designation	Quantity
MSV	35	30 x 30		3h x 3v				

Suspender Uplight Luminaires Type MAU And Cable Mounted Suspender Downlight Luminaires Tupe MAD-C

Suspender uplight luminaires and cable mounted suspender downlight luminaires (suspender luminaires) shall be light emitting diode (LED) fixtures with a mounting suitable for the location shown on the plans.

The shape of the luminaire shall be as shown on the plans. A prototype luminaire shall be submitted for architectural approval prior to delivery.

Each roadway and suspender cable luminaire shall be equipped with a fully adjustable aiming device necessary to achieve the specified light levels and uniformities. Aiming device shall be as shown on the plans or equal, allowing for at least 3 axis of movement (+/- 90 degrees) for aiming. Mounting devices shall be approved by the engineer.

The mounting device shall have easily read etched or stamped angle markings at the pivot points.

Mounting device and hardware shall be Type 316 stainless steel, or of other material of sufficient strength and corrosion resistance.

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Luminaire, mounting device and hardware shall be powder coated with a white finish as selected by the architect.

Luminaires shall be fully assembled, and ready for installation.

Electrical/Photometric Requirements

Suspender luminaires shall come in no more than 4 wattages and only one beam configuration for a maximum of five different suspender luminaires (similar to original metal halide plans), unless needed and approved by engineer to meet the photometric requirements listed below. A table of suspender luminaire types is provided with the original metal halide information. The supplier shall complete the table with the required information for the LED luminaires.

Photometric requirements are that the suspender luminaires have a narrow beam

Supplier shall provide simulations showing that luminaire types and quantities will meet the required performance at installation and throughout the minimum operational life.

For all suspender luminaires, the power supply shall be located in a box on the cable clamp/platform (for cable mounted) or in a box on the suspender cable attachment. See plans for more details.

Main Tower Floodlights Types MAR And MAT

Main tower floodlight fixtures shall be surface, wall or tenon mounted, rectangular shaped, LED floodlight fixtures with mounting brackets, mounting suitable for locations shown on the plans. Fixtures shall be fully assembled, one piece cast aluminum, suitable for marine use, furnished with LED, power supply, and optics.

A prototype luminaire shall be submitted for architectural approval prior to delivery.

Housings shall be one-piece cast aluminum with integrally cast heat dissipating fins.

Luminaire, mounting device and hardware shall be powder coated with a white finish as selected by the architect.

The power supply shall be integral with the lighting fixture, internally mounted in a corrosion resistant cast aluminum finned box with a weather-resistant E.D.P.M. gasket.

Each luminaire shall be equipped with a fully adjustable mounting yoke and adjustable pivot bracket aiming system (mounting device). Mounting device shall be as shown on the plans or equal, allowing for at least 3 axis of movement (+/- 90 degrees) for aiming. Mounting devices shall be approved by the engineer.

The mounting device shall have easily read etched or stamped angle markings at the pivot points.

Mounting device and hardware shall be Type 316 stainless steel, or of other material of sufficient strength and corrosion resistance.

Electrical/Photometric Requirements

Tower floodlight luminaires shall come in no more than four wattages and four beam configurations for a maximum of six different main tower floodlights (similar to original metal halide plans), unless needed and approved by engineer to meet the photometric requirements listed below. A table of main tower floodlight types is provided with the original metal halide information. The supplier shall complete the table with the required information for the LED luminaires.

Main Tower Marker Lights Type MAP

Main tower marker light fixture shall be a 300 mm diameter (approx) lantern using LEDs as the light source. Each fixture shall be shipped fully assembled, furnished with lamps, power supply, transformer, and base and fixture caps, and shall comply with the following requirements.

Each fixture shall have a maximum power consumption of 200 watts.

The fixture shall be IP-66 rated and be constructed of materials and coatings to allow it to pass a 3,000 hour salt spray test per ASTM B 117.

The driver shall be IP-65 rated and remote mounted in a NEMA 4R enclosure mounted on the main tower at a location determined by the Engineer. The manufacturer shall supply a wire harness to connect the driver in the enclosure to the fixture at the top of the tower.

The fixture, driver, and wire harness shall have quick-connect electrical connections. The harness shall be encased in a corrugated plastic tubing to protect the wires from abrasion from the inside of the pole.

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Housing Material

Housing shall consist of anodized aluminum base plate with an anodized aluminum mounting cylinder and a removable anodized aluminum cape secured to the fixture with a threaded cap anchor. Aluminum shall be a marine grade alloy with less than 0.2% copper.

Fixtures shall be equipped with a cast mounting base, suitable for surface mounting to the Roadway Lighting Pole top. Mounting hardware shall be Type 316 stainless steel.

Fixtures shall be UL listed for use in wet locations.

Photometric Requirements

The fixture shall provide a minimum intensity of 1,000 candelas at any point on the horizontal plane and have a minimum beam angle of 60 degrees (between the angles of 30 degrees above and below the horizon) for a minimum operational life of 50,000 hours.

Gonzalo J. Gomez, Jr.
1-24-2011

